

**TAUNTON RIVER BASIN  
NORTON, MASSACHUSETTS**

**CHARTLEY POND DAM  
MA 00814**

**PHASE I INSPECTION REPORT  
NATIONAL DAM INSPECTION PROGRAM**

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**DEPARTMENT OF THE ARMY  
NEW ENGLAND DIVISION, CORPS OF ENGINEERS  
WALTHAM, MASS. 02154**

**APRIL 1979**

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)  The dam is a 200 ft. long, 10 high earthfill dam. The dam is small in size with a hazard classification of high. The overall condition of the dam is fair because the outlet cannot discharge the test flood without overtopping. It is recommended that the owner employ a qualified engineer to perform a detailed hydraulic/hydrologic analysis to evaluate the required outlet capacity.		



DEPARTMENT OF THE ARMY  
NEW ENGLAND DIVISION, CORPS OF ENGINEERS  
424 TRAPELO ROAD  
WALTHAM, MASSACHUSETTS 02154

REPLY TO  
ATTENTION OF:

NEDED

AUG 16 1979

Honorable Edward J. King  
Governor of the Commonwealth of  
Massachusetts  
State House  
Boston, Massachusetts 02133

Dear Governor King:

I am forwarding to you a copy of the Chartley Pond Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Department of Environmental Quality Engineering, the cooperating agency for the Commonwealth of Massachusetts. In addition, a copy of the report has also been furnished the owner, Mr. David Opatha, Director, Town of Norton Conservation Commission, Town Hall, Norton, Massachusetts 02766.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Environmental Quality Engineering for your cooperation in carrying out this program.

Sincerely yours,

MAX B. SCHEIDER  
Colonel, Corps of Engineers  
Division Engineer

Incl  
As stated

CHARTLEY POND DAM

MA 00814

TAUNTON RIVER BASIN

NORTON, MASSACHUSETTS

PHASE I - INSPECTION REPORT  
NATIONAL DAM INSPECTION  
PROGRAM



NATIONAL DAM INSPECTION  
PROGRAM

PHASE I INSPECTION REPORT  
BRIEF ASSESSMENT

Identification No.: MA 00814

Name of Dam: Chartley Pond Dam

Town: Norton

County and State: Bristol County, Massachusetts

Stream: Chartley Brook - Tributary of the Taunton  
River

Date of Inspection: December 1, 1978

Chartley Pond Dam is a 200-foot long 10-foot high earthfill dam built in the 1800's. A two-lane paved roadway is the crest of the dam while the downstream face includes a concrete wall and portions of the foundations for two structures. The embankment is in good condition but minor maintenance is required. Water discharges through a small outlet controlled by stop logs. An outlet at the dam for a water wheel is blocked and abandoned. An outlet controlled by removable stop logs functions as the spillway for the dam. Removable stop logs at the time of the inspection were at El 102.7 with an effective width of 6.7 feet. Fixed weirs at the side of the outlet are at El 104 and have a total width of 8.5 feet.

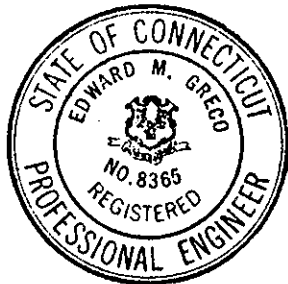
Based on Corps of Engineers' Guidelines, the Dam has been classified as "small" and in the "high" hazard category. Accordingly, a test flood equal to one-half the probable maximum flood (PMF) was used for this analysis. Hydraulic analyses indicate that the outlet can discharge a flow of 170 cfs before overtopping the dam at El 105.6. This discharge represents 14 percent of the outflow test flood discharge of 1,230 cfs. The outflow test flood which crests at El

CHARTLEY POND DAM

107.3 will overtop the dam by 1.7 feet. Draining the pond to El 96.5 prior to the outflow test flood will not appreciably reduce the amount of overtopping. The outlet cannot pass the test flood even with all stop logs removed, and overtopping of 1.2 feet will occur.

It is recommended that the Owner employ a qualified consultant to perform a detailed hydraulic/hydrologic analysis to evaluate the required outlet capacity. Prior to that study the dam should immediately be drained to minimize the potential overtopping. There are no recommended alternatives.

The overall condition of the dam is fair because the outlet cannot discharge the test flood without overtopping. Accordingly, the recommendations and remedial measures outlined above should be implemented within a period of one year after receipt of this Phase I Inspection report.



A handwritten signature in black ink, appearing to read "Edward M. Greco", written over a horizontal line.

Edward M. Greco, P.E.  
Project Manager  
Metcalf & Eddy, Inc.

Connecticut Registration  
No. 08365

Approved by:

A handwritten signature in black ink, appearing to read "Stephen L. Bishop", written over a horizontal line.

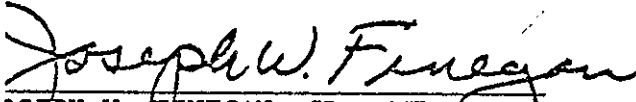
Stephen L. Bishop, P.E.  
Vice President  
Metcalf & Eddy, Inc.

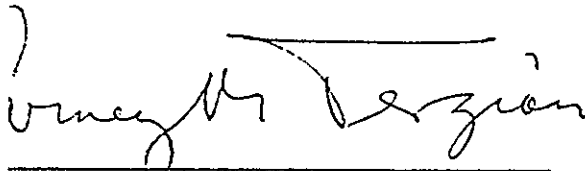
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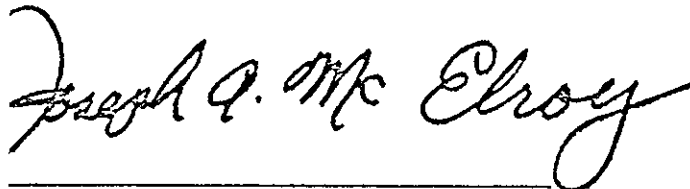


CHARTLEY POND DAM

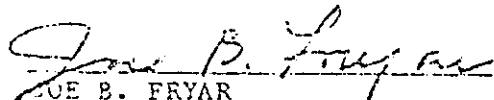
his Phase I Inspection Report on Chartley Pond Dam  
as been reviewed by the undersigned Review Board members. In our  
pinion, the reported findings, conclusions, and recommendations are  
onsistent with the Recommended Guidelines for Safety Inspection of  
ams, and with good engineering judgment and practice, and is hereby  
ubmitted for approval.

  
JOSEPH W. FINEGAN, JR., MEMBER  
ater Control Branch  
ngineering Division

  
ARNEY M. TERZIAN, MEMBER  
esign Branch  
ngineering Division

  
JOSEPH A. MCELROY, CHAIRMAN  
Chief, NED Materials Testing Lab.  
Foundations & Materials Branch  
Engineering Division

APPROVAL RECOMMENDED:

  
JOE B. FRYAR  
Chief, Engineering Division

## PREFACE

This report is prepared under guidance contained in Recommended Guidelines for Safety Inspection of Dams, for a Phase I Investigation. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigations, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff, or fractions thereof). Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate

CHARTLEY POND DAM

condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general conditions and the downstream damage potential.

CHARTLEY POND DAM

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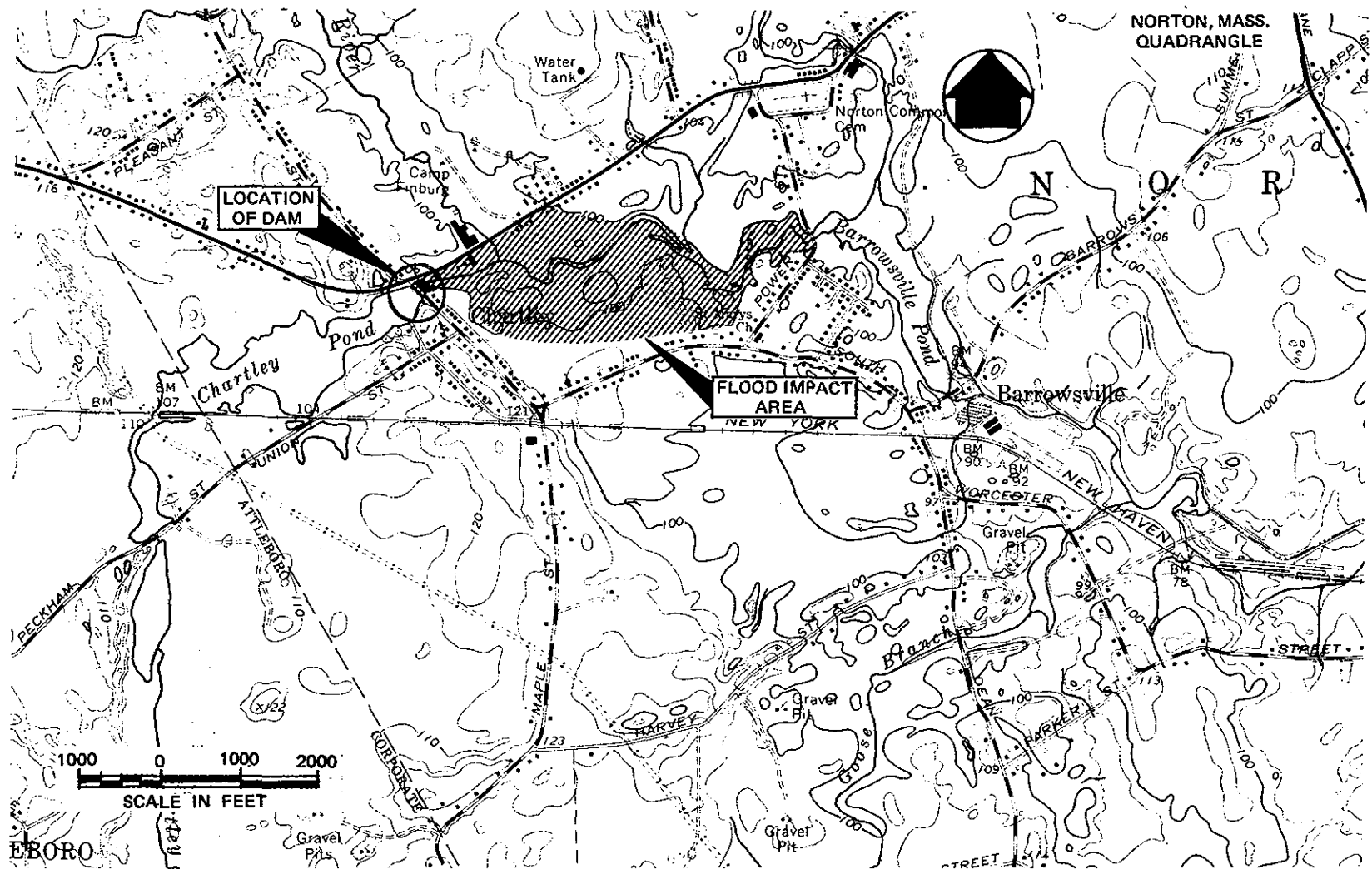
CHARTLEY POND DAM



**OVERVIEW  
CHARTLEY POND DAM  
NORTON, MASSACHUSETTS**







LOCATION MAP – CHARTLEY POND DAM

NATIONAL DAM INSPECTION  
PROGRAM

PHASE I INSPECTION REPORT

CHARTLEY POND

SECTION 1

PROJECT INFORMATION

1.1 General

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Metcalf & Eddy, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Massachusetts. Contract No. DACW 33-79-C-0016 dated November 28, 1978 has been assigned by the Corps of Engineers for this work.

b. Purpose

- (1) Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.
- (2) Encourage and assist the States to quickly initiate effective dam safety programs for non-Federal dams.
- (3) Update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location. The dam is located on Chartley Pond, a tributary of Taunton River in the

CHARTLEY POND DAM

Town of Norton, Bristol County, Massachusetts  
(see Location Map and Drainage Area Map).

- b. Description of Dam and Appurtenances. Chartley Pond Dam consists of a 200-foot long, 10-foot high earthfill dam. The crest of the dam, consists of South Worcester Street, a two-lane city street, and a small parking area for the Sinclair Mfg. Co. The 30-foot wide street is paved and drainage catchbasins located at the edge of the pavement discharge into the outlet conduit. Immediately adjacent to the downstream face of the dam are two multi-story brick and wood frame structures. The foundation to the structures form an integral part of the downstream face of the dam. The embankment fill between the pavement and the structures is grass covered and generally slopes toward the downstream side. The downstream face of the dam consists of a concrete wall between the two structures, separated by the discharge channel. The crest of the dam along the crown of the road varies between Elevation (El) 105.6 to El 106.1.

The entrance to the outlet conduit is through a concrete structure covered with a concrete slab. Openings are located along the front and sides. The two openings in the front (upstream) are controlled by 2-inch thick stop logs. Each opening at the time of inspection was 3.35-feet wide and 2.6-feet high from the bottom of the slab to the top of the removable stop logs. The invert of the stop logs were at El 96.5. The fixed openings on the sides are barred and 4.25-feet long by 1.3-feet high. Discharge to the downstream channel is through a dry stone masonry conduit. The conduit has three channels, one of which had no flow because of debris. The two channels which are in operation vary in cross-section. Generally, they are about 3- to 5-feet wide and 5- to 6-feet high although there are some local restrictions in width and height within the channel. The two downstream openings narrow to 3 feet and 3-1/2 feet.

CHARTLEY POND DAM

A second outlet, which is apparently clogged with debris or otherwise blocked, is located near the west abutment of the dam. This outlet at one time provided water for power for the building across the street (presently the Balfour Co.). Discharge from the intake flowed through a water wheel within the building and out into the downstream channel. Remnants of the foundation to a gate operating mechanism remain on the intake structure. The valve for the pipe is located within the Balfour Co. building but is owned by the Town of Norton.

The upstream face of the dam consists of a one-foot thick concrete wall. Vertical cracks, varying in thickness from hairline to about 1/4-inch occur at about 3- to 5-foot intervals along the wall.

A small one-story wood frame building is located adjacent to the east abutment where the dam ties into natural ground. The west abutment consists of natural ground which forms a part of Route 123.

- c. Size Classification. Chartley Pond Dam is classified in the "small" category since it has a maximum height of 10 feet and a maximum storage capacity of about 430 acre-feet.
- d. Hazard Classification. Immediately downstream of the dam are two small factories and a parking area for the Balfour Company. Further downstream along the discharge channel are several small businesses and residences. A failure of the dam could adversely affect people within the downstream buildings. Excessive property damage as well as a loss of life is possible. Accordingly the dam has been placed in the "high" hazard category.
- e. Ownership. The dam is owned by the Town of Norton Conservation Commission. Mr. David Opatka, Director, Town Hall, Norton, Massachusetts, 02766, (617-285-6301) granted permission to enter the property and inspect the dam.
- f. Operators. The dam is operated by personnel from the Town of Norton. The single operating

CHARTLEY POND DAM

outlet is regulated by manually adjusting the stop logs. The abandoned outlet reportedly is not operable.

- g. Purpose of Dam. Presently, the water in Chartley Pond is not being used. The dam serves only to form an impoundment to control algae development in the upper pond.
- h. Design and Construction History. No information is available on the design and construction history of the dam.
- i. Normal Operating Procedures. The stop logs at the outlet can be adjusted manually. Some are reportedly removed as soon as possible to lower the reservoir in anticipation of storms. The logs are subsequently replaced to keep the pond from becoming too low. Pool level at the time of the inspection was El 103.2. High pool should not reportedly exceed El 104.5, which is denoted by a steel pin at the outlet structure along the upstream wall.

### 1.3 Pertinent Data

- a. Drainage Area. The approximately 4,333-acres (6.77 square miles) drainage area includes numerous small ponds and swamps mostly in the neighboring Town of Attleboro to the west. An estimated 5 to 10 percent of the drainage area is residential with a portion being in downtown Attleboro. The land area is generally flat. Several gravel pits are noted within the area.
- b. Discharge. Normal discharge is through an outlet channel beneath South Worcester Street where the flow is contained in a dry stone masonry conduit. This conduit discharges into a natural stream adjacent to and between the two factories downstream. Flow eventually discharges into Barrowsville Pond about 1/2 mile downstream. Flow from Barrowsville Pond continues eventually to the Taunton River.

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Hydraulic analysis indicates that at the outflow test flood discharge rate of 1,230 cfs with stop logs at El 102.7 the dam will be overtopped by 1.7 feet. Even with all stop logs removed. The dam will be overtopped by 1.2 feet.

- c. Elevation (feet above MSL (Mean Sea Level)). A benchmark was established at El 106.0 on the top of the outlet wall. This elevation was estimated from a United States Geological Survey (USGS) topographic map. All elevations used are based on conditions observed in the field at the time of the inspection. All hydraulic calculations are based on the top of stop logs at El 102.7.

- (1) Top dam: 105.6 to 106.1
- (2) Test flood pool: 107.3 (with stop logs at El 102.7)
- (3) Design surcharge (original design): Unknown
- (4) Full flood control pool: N/A
- (5) Recreation pool: 102.7
- (6) Outlet crest (top of stop logs): 102.7
- (7) Upstream portal invert diversion tunnel: N/A
- (8) Streambed at outlet of dam: 96.0
- (9) Tailwater: N/A

d. Reservoir

- (1) Length of maximum pool: 6,800 feet
- (2) Length of recreation pool: 6,800 feet
- (3) Length of flood control pool: N/A

CHARTLEY POND DAM

e. Storage (acre-feet)

- (1) Test flood surcharge: 340 at El 107.3
- (2) Top of dam: (upstream face) 430 at El 105.4
- (3) Flood control pool: N/A
- (4) Recreation pool: 230 (Approximate)
- (5) Spillway crest: 230

f. Reservoir Surface (acres)

- \*(1) Top dam: 74.4
- \*(2) Test flood pool: 74.4
- (3) Flood-control pool: N/A
- (4) Recreation pool: 74.4
- (5) Spillway crest: N/A

g. Dam

- (1) Type: Earthfill
- (2) Length: 240 feet
- (3) Height: (maximum) 10 feet
- (4) Top width: 75 feet
- (5) Side slopes: Upstream; vertical concrete wall  
Downstream; concrete wall and foundation structures
- (6) Zoning: Unknown
- (7) Impervious core: Unknown
- (8) Cutoff: Unknown
- (9) Grout curtain: Unknown

\*Based on the assumption that the surface area will not significantly increase with changes in pond elevation from 102.7 to 107.3.

CHARTLEY POND DAM

- i. Spillway. There is no spillway at this site. The outlet conduit discharges normal flows.
- j. Regulating Outlets. Two outlets exist at the dam. Aside from the discharge outlet, a second outlet has not been operated for years according to the Owner and is blocked. The outlet to the dam is controlled by manually operated stop logs. Removal of all the stop logs will substantially lower the reservoir to about El 96.5.

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## SECTION 2

### ENGINEERING DATA

- 2.1 General. There are four pages of sketches, and sections of past inspection reports, available for the dam (see pages B-3, B-6, B-10 to B-12). These sketches show views of the outlet structure and intake, and one is a plan of the upstream face of the dam. No other plans, specifications, or computations are available from the Owner, State, or County offices relative to the design, construction, or repair of this dam.

We acknowledge the assistance and cooperation of Mr. David Opatka, Director of the Norton Conservation Commission; and Mr. Larry DeSantos of Sinclair Manufacturing Company.

- 2.2 Construction Records. There are no as-built drawings for the dam.

- 2.3 Operating Records. There are no operating records available, and no daily record is kept of the elevation of the pool or rainfall at the dam site.

2.4 Evaluation

- a. Availability. There are no engineering data available.
- b. Adequacy. The lack of detailed hydraulic, structural, and construction data did not allow for a definitive review. Therefore, the evaluation of the adequacy of this dam is based on the visual inspection, past performance history, and engineering judgment.
- c. Validity. Drawings shown in this report are consistent with observed field conditions.

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SECTION 3  
VISUAL INSPECTION

3.1 Findings

- a. General. The Phase I Inspection of the dam at Chartley Pond was performed on December 1, 1978. A copy of the inspection checklist is included in Appendix A. Previous inspections of the dam have been made by others in the past. Records of inspections made in 1959, 1968, 1970, and 1974 are included in Appendix B.
- b. Dam. Chartley Pond Dam is an earthfill dam, the crest of which includes South Worcester Street, a two-lane city street. The crest of the dam is in good condition. The road in this area is a vertical curve with the lowest elevation in the vicinity of the outlet. The pavement is also in good condition. Drainage from the road is collected at each edge in catchbasins which discharge into the outlet channel.

The upstream face of the dam is comprised of a continuous concrete wall (no joints) in fair condition. Minor cracking was noted in regular intervals along the wall. The cracks ranged in size from hairline to about 1/4 inch. The concrete face was pitted and stained. Minor erosion, in the form of small holes, between the wall at the outlet and the embankment was evident.

The downstream wall is constructed of concrete. In several areas along the foot of the wall the concrete was eroded and broken. A leak under the downstream wall, reported in a past inspection report, could not be examined because water was discharging through the channel. It is assumed that the leak still exists. Buildings housing Sinclair Manufacturing and Balfour Company are located on either side of the outlet discharge channels.

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The basement of each structure is adjacent to the embankment of the dam. In the past, water from the pond was used at each of these structures. The downstream face appeared in good condition. The earthen portion of the downstream section of the dams was covered with grass except for a small paved parking area.

A depression was observed at the grassed area near the edge of the outlet discharge channel. It appears that soil may have infiltrated through the void in the stone masonry of the discharge conduit.

The abutments of the dam tie into natural ground. The east end continued as South Worcester Street while the west abutment is located at the intersection of South Worcester Street and Route 123.

- c. Appurtenant Structures. Two outlets exist at the dam. One, on the west end is an abandoned and blocked intake into the present Balfour Company. The Owner stated that the intake was blocked at the upstream face of the dam and that a valve control located within the Balfour Company Building has not been operated in several years. Discharge from this outlet would flow through the building and into the downstream channel. No other information was available on this outlet.

Discharge through the outlet of the dam is controlled by wooden stop logs. The sides of the outlet structure have two fixed weirs. Removing all of the stop logs will drain the pond. The concrete structure was in good condition. Just to the east of the structure was a steel pin which the Owner stated marked the legal "high water limit" (El 104.5). Staining along the structure and upstream wall indicated the pond level rarely rose above this elevation for long periods of time.

The discharge conduit separates into three channels under the road. The channels were

CHARTLEY POND DAM

constructed of dry stone masonry and appeared in satisfactory condition. The channels vary in width. The three channels discharge into two downstream openings, one 3-feet wide by 5.3- feet high and the other 3.5-feet wide by 6.1- feet high. Water passes from these openings into the downstream channel.

- d. Reservoir Area. The area around Chartley Pond is undeveloped, except immediately at the dam. The area consists mostly of flat, swampland. Chartley Pond reportedly resulted from excavating iron ore used at the Old Lennon Forge Iron Works (Balfour Company structure) at the dam. Peckham Street and a railroad track cross the reservoir area.
- e. Downstream Channel. Discharge through the outlet conduit flows between the Balfour Company and Sinclair Manufacturing Company. The flow is contained between stone masonry walls and the foundation of Balfour and Sinclair buildings. About 100 to 200 feet downstream, the area flattens out and discharge is through a shallower natural stream. Small trees line the channel. Eventually flow discharges into the upper reach of Barrowsville Pond about 2,000 feet downstream.

- 3.2 Evaluation. The above findings indicate that the physical condition of the embankment is good. Continued maintenance and the recommendations as listed in Section 7.3 are necessary at this time.

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SECTION 4  
OPERATING PROCEDURES

- 4.1 Procedures. According to the Owner, the dam is inspected periodically. Generally one 8-inch stop log is reportedly removed, if possible, 2-3 days before imminent storms and replaced when the storm has passed. The stop logs have been removed by unauthorized persons on many occasions and therefore it has been difficult to maintain a high water level.
- 4.2 Maintenance of the Dam. There is no specific maintenance program for the dam. However, because of its location abutting private property and its use as a roadway, little additional maintenance is required by the Owner.
- 4.3 Maintenance of Operating Facilities. There is no specific maintenance program for the operating facility.
- 4.4 Description of Any Warning System in Effect. There is no warning system in effect at this dam. However, it is anticipated that abutters would be aware of the water level in the pond and could take appropriate action such as notifying the Owner or other Town authorities.
- 4.5 Evaluation. There is no regularly scheduled maintenance program. However, the Owner periodically visits the dam. Because of the location and construction of the dam very little maintenance by the Owner is required. A systematic and complete inspection program should be instituted at the dam. Maintenance, as required, should continue to be performed.

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## SECTION 5

### HYDRAULIC/HYDROLOGIC

#### 5.1 Evaluation of Features

- a. General. Drainage to Chartley Pond originates in generally flat swampland in the Towns of Attleboro and Norton. The drainage area consists of about 6.8 square miles of sparsely populated land. An outlet consisting of a small diameter pipe, now abandoned, provided water to a structure occupied by the Balfour Company. Because the control valve for the pipe is downstream from the dam the pipe is always under a hydraulic head. The only other outlet is a conduit and outlet structure which is provided with removable stop logs. Each side of the structure is provided with a fixed level outlet 4.25 feet long which is fitted with a bar rack. The front of the structure was designed for the installation of stop logs which produce a weir 6.7 feet long. At the time of the inspection the stop logs were set at El 102.7. Two fixed weirs are at El 104. Both openings are covered by a concrete slab having a bottom at El 105.3. A high water marker has been installed at El 104.5. The capacity of the discharge channels are controlled by two openings which are 3 feet by 5.3 feet and 3.5 feet by 6.1 feet. (See Figures B-1 and B-2).

Overtopping of the upstream wall occurs at about El 105.4. The roadway will be overtopped at about El 105.6. The invert of the upstream side of the two outlets is about El 96.5 which is assumed to be the bottom of the pond. The elevation of the invert of the discharge conduit at the downstream side of the stop logs is El 96.5. The invert at the discharge end is El 95.0. There is no other low level outlet at the dam.

CHARTLEY POND DAM

- b. Design Data. There are no hydraulic computations available for the design of this dam.
- c. Experience Data. Hydraulic records are not available for this dam. Detailed information on the past performance of the dam is unknown. The Owner stated he has had difficulty maintaining high water levels because of unauthorized persons removing the stop logs. A past inspection report indicated the Owner was able to maintain a water level which prevented overtopping of the dam in the 1955 (record) flood. However, minor overtopping of the dam has reportedly occurred periodically.
- d. Visual Observation. The outlet structure appears in good condition. Water is impounded by the use of stop logs which could be removed although with some difficulty.
- e. Test Flood Analysis. The Probable Maximum Flood (PMF) rate was determined to be 400 cfs per square mile. This calculation is based on the average slope of the drainage area of 0.7 percent, the pond-plus-swamp area to drainage area ratio of 29.5 percent, and the U.S. Army Corps of Engineers' guide curves for Maximum Probable Flood Peak Flow Rates (dated December 1977). Applying one-half the full PMF to the 6.77 square miles of drainage area results in a calculated peak flood flow of 1,400 cfs as the inflow test flood. By adjusting the inflow test flood for surcharge storage, the maximum discharge rate was established as 1,230 cfs (182 cfs per square mile), with a water surface at El 107.3. This analysis assumes stop logs placed to El 102.7 and the abandoned outlet closed.

Hydraulic analysis indicates that the outlet can discharge 150 cfs at El 105.4 which is the elevation of the top of the upstream wall of the dam. At this elevation water begins to spill onto the roadway and crest of the dam.

At the maximum discharge rate of 1,230 cfs at El 107.3 the roadway and low area on the crest

CHARTLEY POND DAM

of the dam (El 105.6) would be overtopped by 1.7 feet. At El 105.6 the outlet would be discharging 170 cfs or 14 percent of the test flood.

The impact of permanently removing all the stop logs (to El 96.5) was evaluated. Under these conditions, the outlet conduit would pass 37 percent of the test flood before overtopping at El 105.6. Overtopping would be 1.2 feet at El 106.8.

Completely draining the pond prior to the test flood has little effect on preventing overtopping under the test flood. Prior inspection reports also indicate the dam has inadequate outlet capacities.

Historical information and past inspection reports indicate the dam was not overtopped in the 1955 (record) flood. The Owner states that the dam has been overtopped in several instances because stop logs were not removed sufficiently ahead of time. During the times the dam was overtopped the road remained passable to trucks. No damage to the dam or adjacent structures occurred.

With the water surface at El 102.7 (present top of stop logs), no inflow, and the removal of 1 foot of stop logs the dam could be lowered 1 foot in about four days. Under the same condition, if 4 feet of stop logs were removed, the pond could be lowered 1 foot in about 12 hours.

- f. Dam Failure Analysis. Assuming a failure of the dam with the water surface at El 105.6, which is the lowest elevation on the crest of the roadway and dam, the peak discharge flood flow would be about 1,100 cfs. At El 105.6, the spillway would be discharging 170 cfs which would produce a 4-foot depth of flow. Failure of the dam would produce a total depth of 7.8 feet in the channel. It is probable that the resulting flood wave could have a severe impact on the Sinclair Manufacture and Balfour Co. buildings immediately downstream as well as several businesses and a few residences further downstream. The approximate flood impact area is shown on the location map, page iv.

CHARTLEY POND DAM



## SECTION 6

### STRUCTURAL STABILITY

#### 6.1 Evaluation of Structural Stability

- a. Visual Observations The evaluation of the structural stability of Chartley Pond Dam is based on the visual inspection conducted on December 1, 1978. A detailed discussion of the visual inspection appears in Section 3. Based on this inspection the dam is considered to be in good condition except for the outlet which cannot pass the test flood.

Except for increasing the capacity of the outlet, only minor maintenance and regular inspections are required to assure continued performance of the dam.

- b. Design and Construction Data. Discussion with the Owner and State personnel indicate there are no available plans, specifications or computations on the design, or construction of the original dam.

Information does not appear to exist on the type, shear strength, and permeability of the soil and/or rock materials of the embankment.

- c. Operating Records. There is no instrumentation of any type in Chartley Pond Dam, and no instrumentation was ever reported installed in this dam. The performance of this dam under prior loading can only be inferred from physical evidence at the site.
- d. Post-Construction Changes. There are no as-built drawings available for Chartley Pond Dam.
- e. Seismic Stability. The dam is located in Seismic Zone No. 2, and in accordance with recommended Phase I guidelines, does not warrant seismic analysis at this time.

CHARTLEY POND DAM

## SECTION 7

### ASSESSMENT, RECOMMENDATIONS, AND REMEDIAL MEASURES

#### 7.1 Dam Assessment

- a. Condition. Based upon a visual inspection of the site and limited operational or maintenance information, there are minor deficiencies which should be corrected to assure continued performance of the dam. Generally, the dam is considered to be in fair condition since the outlet cannot discharge the test flood without overtopping the dam.

Hydraulic analysis indicate that the outlet can discharge 170 cfs with the water surface at El 105.6 which is the low point on the crest of the roadway. An outflow test flood of 1,230 cfs (one-half PMF) at El 107.3 will overtop the dam by 1.7 feet. This analysis was based on stop logs positioned to El 102.7. Even if all the stop logs were removed the dam would still be overtopped during the test flood.

- b. Adequacy. The lack of detailed design and construction data did not allow for a definitive review. Therefore, the evaluation of the adequacy of this dam is based primarily on visual inspection, past performance, and engineering judgment.
- c. Urgency. The recommendations and remedial measures should be implemented by the Owner within one year after receipt of this Phase I Inspection Report.
- d. Need for Additional Investigation. Additional investigations to further assess the adequacy of the outlet are outlined below in Section 7.2 Recommendations.

CHARTLEY POND DAM

- 7.2 Recommendations. It is recommended that the Owner employ a qualified consultant to perform a detailed hydraulic/hydrologic analysis for the purpose of increasing the outlet capacity.

Recommendations on repairs and maintenance procedures are outlined below under Section 7.3 Remedial Measures.

7.3 Remedial Measures.

- a. Operating and Maintenance Procedures. The overall condition of both the dam and appurtenant structures appear to be in fair condition because of the small spillway capacity. It is recommended that the following specific maintenance or actions be performed:

- (1) Until such time as when the hydraulic analysis and evaluation has been completed and recommendations incorporated, all the stop logs should be removed and the pond drained to minimizing potential overtopping.
- (2) Fill holes near the downstream wall and at the outlet.
- (3) Investigate the condition of the blocked outlet.
- (4) Implement a systematic program of maintenance inspections. As a minimum the inspection program should consist of a bi-monthly (every two months) inspection of the dam and appurtenances, supplemented by additional inspections during and after severe storms. All repairs and maintenance should be undertaken in accordance with all applicable State regulations.
- (5) Technical inspection of this dam should be continued on a bi-ennial (every two years) basis.

CHARTLEY POND DAM

- (6) Institute a definite plan for surveillance and a warning system during periods of unusually heavy rains and/or runoff.

7.4 Alternatives. There are no recommended alternatives.

CHARTLEY POND DAM

APPENDIX A  
PERIODIC INSPECTION CHECKLIST

CHARTLEY POND DAM

# PERIODIC INSPECTION

## PARTY ORGANIZATION

PROJECT CHARTLEY POND DAM

DATE DEC. 1, 1978

TIME 8 AM - 12 Noon

WEATHER Clear, cold

W.S. ELEV. 103.21 U.S.      DN.S.

### PARTY:

Assumed benchmark El. 106 at  
outlet structure

- |                       |                                 |
|-----------------------|---------------------------------|
| 1. <u>R. Weber</u>    | 6. <u>                    </u>  |
| 2. <u>C. Sweet</u>    | 7. <u>                    </u>  |
| 3. <u>W. Checchi</u>  | 8. <u>                    </u>  |
| 4. <u>H. Lord</u>     | 9. <u>                    </u>  |
| 5. <u>L. Branagan</u> | 10. <u>                    </u> |

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.	<u>Dam</u>	<u>Weber/Branagan</u>	
2.	<u>Spillway</u>	<u>Weber/Branagan</u>	
3.	<u>                    </u>		
4.	<u>                    </u>		
5.	<u>                    </u>		
6.	<u>                    </u>		
7.	<u>                    </u>		
8.	<u>                    </u>		
9.	<u>                    </u>		
10.	<u>                    </u>		

# PERIODIC INSPECTION CHECK LIST

PROJECT CHARTLEY POND DAM DATE Dec. 1, 1978  
 PROJECT FEATURE Dam NAME R. Weber  
 DISCIPLINE Geotechnical NAME \_\_\_\_\_

AREA EVALUATED	CONDITIONS
<u>DAM EMBANKMENT</u>	
Crest Elevation	Elevation varies from El. 105.6 to El. 106.1
Current Pool Elevation	El. 102.7
Maximum Impoundment to Date	Unknown
Surface Cracks	None visible
Pavement Condition	Excellant
Movement or Settlement of Crest	None visible
Lateral Movement	None visible
Vertical Alignment	Sag curve
Horizontal Alignment	Straight
Condition at Abutment and at Concrete Structures	Good-ties into natural ground and roadway
Indications of Movement of Structural Items on Slopes	None visible
Trespassing on Slopes	Roadway
Sloughing or Erosion of Slopes or Abutments	Erosion at outlet headwall-minor depression in crest at outlet conduit discharge end
Rock Slope Protection - Riprap Failures	Concrete wall forms upstream face
Unusual Movement or Cracking at or near Toes	None visible
Unusual Embankment or Downstream Seepage	None visible
Piping or Boils	None visible
Foundation Drainage Features	Unknown
Toe Drains	Unknown
Instrumentation System	Unknown

# PERIODIC INSPECTION CHECK LIST

PROJECT CHARTLEY POND DAM DATE DEC. 1, 1978  
 PROJECT FEATURE Dam NAME R. Weber  
 DISCIPLINE Geotechnical NAME \_\_\_\_\_

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE</u>	
a. Approach Channel	
Slope Conditions	None
Bottom Conditions	Submerged
Rock Slides or Falls	None visible
Log Boom	None
Debris	None visible
Condition of Concrete Lining	Unknown
Drains or Weep Holes	Unknown
b. Intake Structure	
Condition of Concrete	Unknown
Stop Logs and Slots	Unknown



# PERIODIC INSPECTION CHECK LIST

PROJECT CHARTLEY POND DAM DATE Dec. 1, 1978  
 PROJECT FEATURE Dam NAME R. Weber  
 DISCIPLINE Geotechnical NAME \_\_\_\_\_

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - TRANSITION AND CONDUIT</u>	Conduit formed by dry stone masonry-good condition
General Condition of Concrete	
Rust or Staining on Concrete	Not applicable
Spalling	Not applicable
Erosion or Cavitation	Not applicable
Cracking	Not applicable
Alignment of Monoliths	Good-no masonry out of place
Alignment of Joints	Not applicable
Numbering of Monoliths	Not applicable

# PERIODIC INSPECTION CHECK LIST

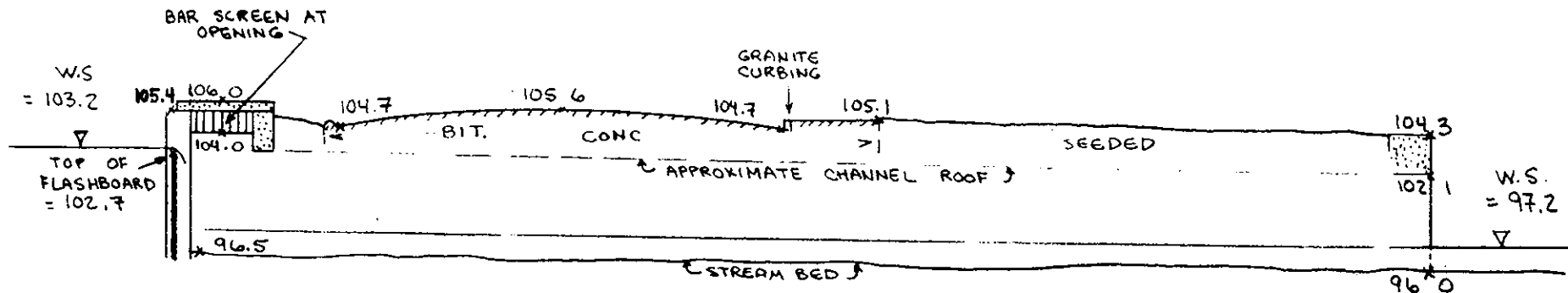
PROJECT CHARTLEY POND DAM DATE Dec. 1, 1978  
 PROJECT FEATURE Outlet NAME R. Weber/L. Branagan  
 DISCIPLINE Geotechnical/Hydraulics NAME \_\_\_\_\_

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL</u>	Generally good-some erosion at water line Periodic cracks (hairline to $\frac{1}{4}$ " )
<u>General Condition of Concrete</u>	
<u>Rust or Staining</u>	Moderate staining below water line
<u>Spalling</u>	None visible
<u>Erosion or Cavitation</u>	None visible upstream-slight at toe of downstream wall
<u>Visible Reinforcing</u>	None visible
<u>Any Seepage or Efflorescence</u>	None visible
<u>Condition at Joints</u>	Fair
<u>Drain Holes</u>	None visible
<u>Channel</u>	
<u>Loose Rock or Trees Over- hanging Channel</u>	None overhanging but small trees and boulder within channel
<u>Condition of Discharge Channel</u>	Fair

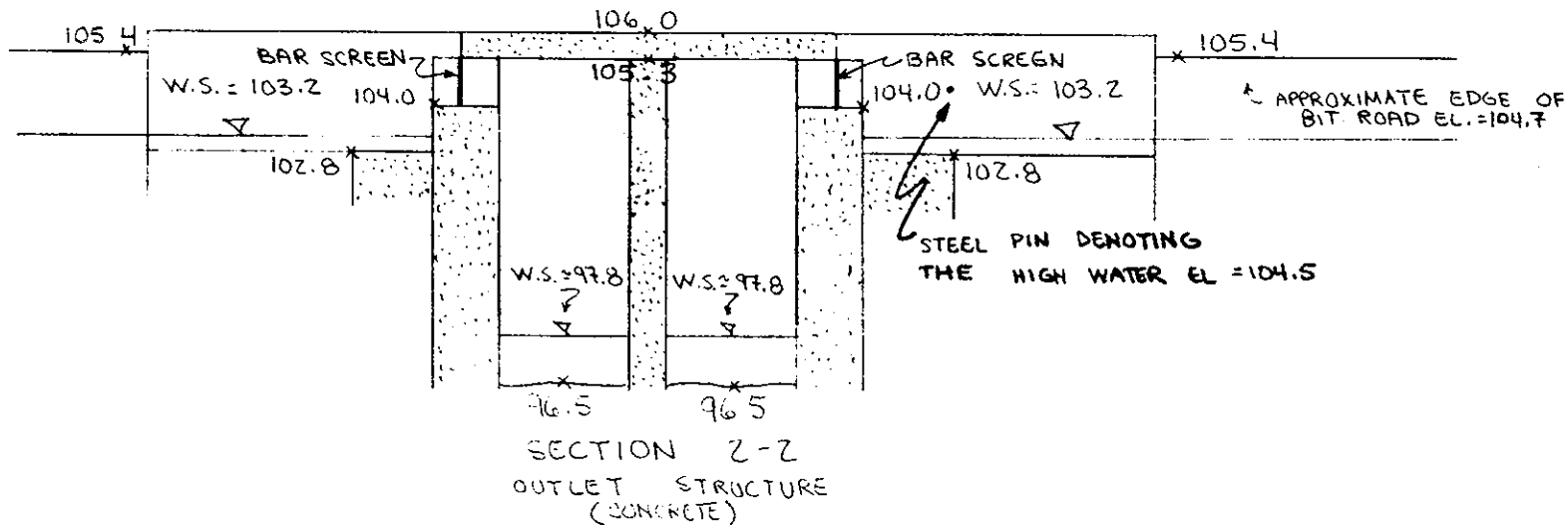
APPENDIX B  
PLANS OF DAM AND PREVIOUS  
INSPECTION REPORTS

	<u>Page</u>
Figure B-1, Plan of Dam	B-1
Figure B-2, Sections Through Dam	B-2
Previous Inspections	B-3



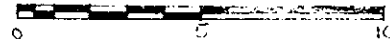


SECTION 1-1  
OUTLET CHANNEL  
SCALE IN FEET



SECTION 2-2  
OUTLET STRUCTURE  
(CONCRETE)

SCALE IN FEET



STATE OF MASSACHUSETTS	DEPARTMENT OF HIGHWAYS
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS	
CHARTLEY POND DAM	
FIGURE B-2 SECTION THROUGH DAM	
DATE: MARCH, 1979	MASSACHUSETTS

# BRISTOL COUNTY, MASS. DATA SHEET & INSPECTION FORM FOR DAMS

Location: Norton Date of Inspection: 1/6/59  
 No. 1 Inspected By: JHR - RMR  
 Name: Chartley Pond Organization: Hayden, Harding & Buchanan, Inc.

Location: USGS Quad Norton Lat 41° 57'-00" N. Long 71° 19'-40" W  
 Reference: Upstream of Old Sturdy Mill, South Worcester Street  
 (Planned - to use pond as heat exchange-Sinclair opposed to elimination of dam)

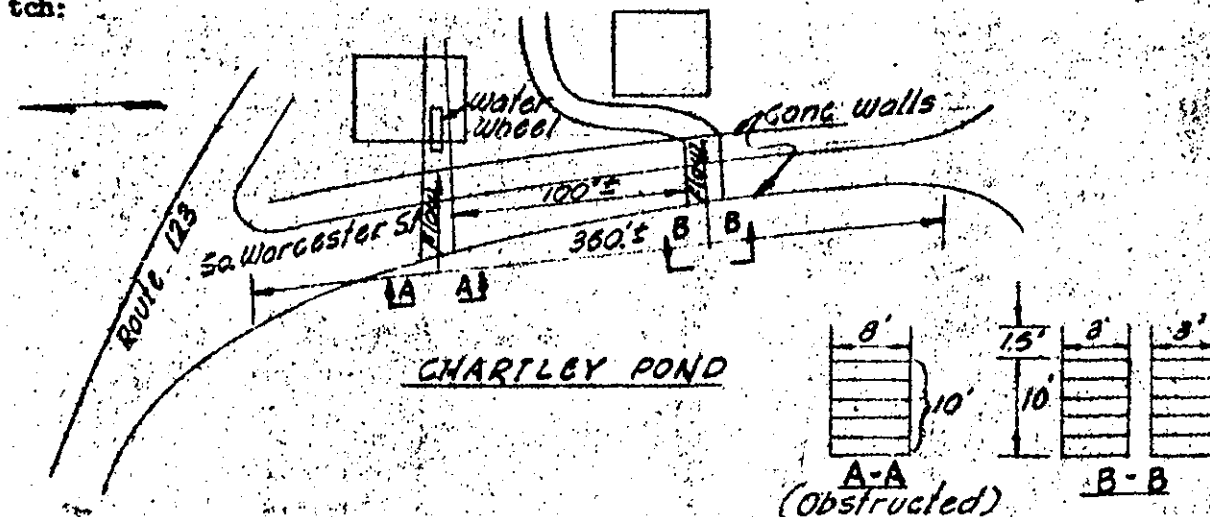
Owner of Dam: Sinclair Mfg. Function of Dam: None at present

Seeds per Div. of Waterways, Mass. DFW)  
 Drainage Area: 6.2 sq. mi. Character of D.A.: flat, swampy  
 Design Flood: 2100 cfs reduced to 500 cfs by available storage capacity  
 Date of Record (date): 1955 Discharge (or high water el.):  
Design Flood = 700 cfs (per House #3270)

General Description of Dam and Discharge Control:  
Earth - 2 sluiceways - manually withdrawn stoplogs.  
Northerly sluiceway obstructed by debris  
Downstream channel is inadequate.

Estimated Discharge Capacity: 350 cfs (5' head, 14' eff. length)

Sketch:



Remarks and Recommendations: Reconstruction proposed in House #3270  
Discharge provisions inadequate.  
Downstream channel inadequate  
Owner has however, been able to maintain pond elevation  
during all floods of 1955 (record year)

Recommend new spillway,  
Channel widening downstream.

General  
Condition

Good

Fair **X**

Poor

Priority **3**

# BRISTOL COUNTY, MASS. INSPECTION REPORT & DATA FOR DAMS

PREPARED FOR THE BRISTOL COUNTY COMMISSIONERS  
BY HAYDEN, HARDING & ECHANAN, INC., BOSTON, MASS.

Owner: Sinclair Mfg. - So. Worcester Street  
 His Address: (Planned to use pond as heat exchange  
 \* Function of Dam: Sinclair opposed to elimination of dam)  
 Location & Access: Upstream of Old Sturdy Mill, South  
Worcester Street

USGS Quad. Norton Lat. 41° 57' 00" Long. 71° 13' 40"

Drainage Area: 6.2 sq. mi.; Ponds:        ac.; Res. @ dam:        ac.

Character of D.A.: flat, swampy

Estimated Discharge: 350 cfs (5' head, 14' eff. length)

Capacity:       

Dam No. No-1

Town: Norton

Stream:       

Pond: Chartley Pond

Date: 1-6-59

By: JHR - RMB

CONDITION RATING

Structural:       

Hydraulic:       

General: Fair

3

PRIORITY:       

KIMMISON-COLBY FLOODS

Minor:        cfs

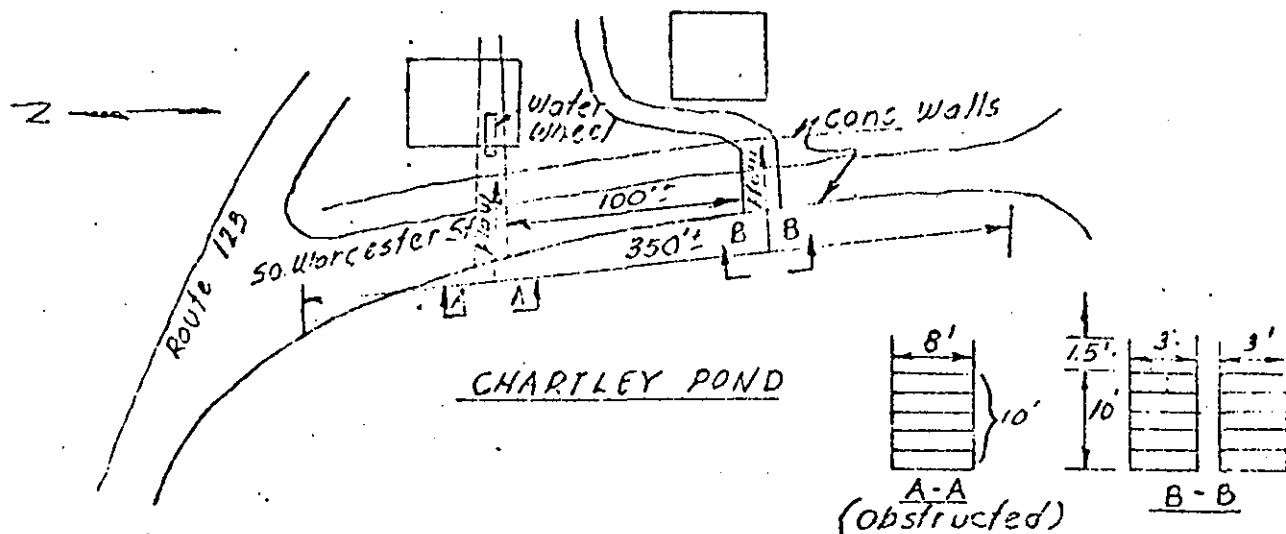
Major: 2100 \* cfs

Rare:        cfs

Maximum:        cfs

General Description of Dam and Discharge Control: Earth - 2 sluiceways -  
manually withdrawn stonlogs. Northerly sluice obstructed by debris.  
Downstream channel is inadequate.

Sketch (Not to Scale):



Remarks and Recommendations: Reconstruction proposed in House #3270  
Discharge provisions inadequate. Downstream channel inadequate. Owner  
has, however, been able to maintain pond elevation during all floods of  
1955 (record year) Recommend new spillway, Channel widening downstream.

Floods per Div. of Waterways, Mass. DPW)

\* reduced to 500 cfs by available storage capacity

Design Flood = 700 cfs (per House #3270)

Date	By	Comment
3-25-68	JNS	Same Condition

Dam No. No-1

**BRISTOL COUNTY, MASS.**  
**INSPECTION REPORT FOR DAMS**

PREPARED FOR THE BRISTOL COUNTY COMMISSIONERS  
BY UNIVERSAL ENGINEERING CORP., BOSTON, MASS.

DAM NO. No - 1  
TOWN: Norton

INSPECTION  
DATE

REMARKS & RECOMMENDATIONS

3-24-70

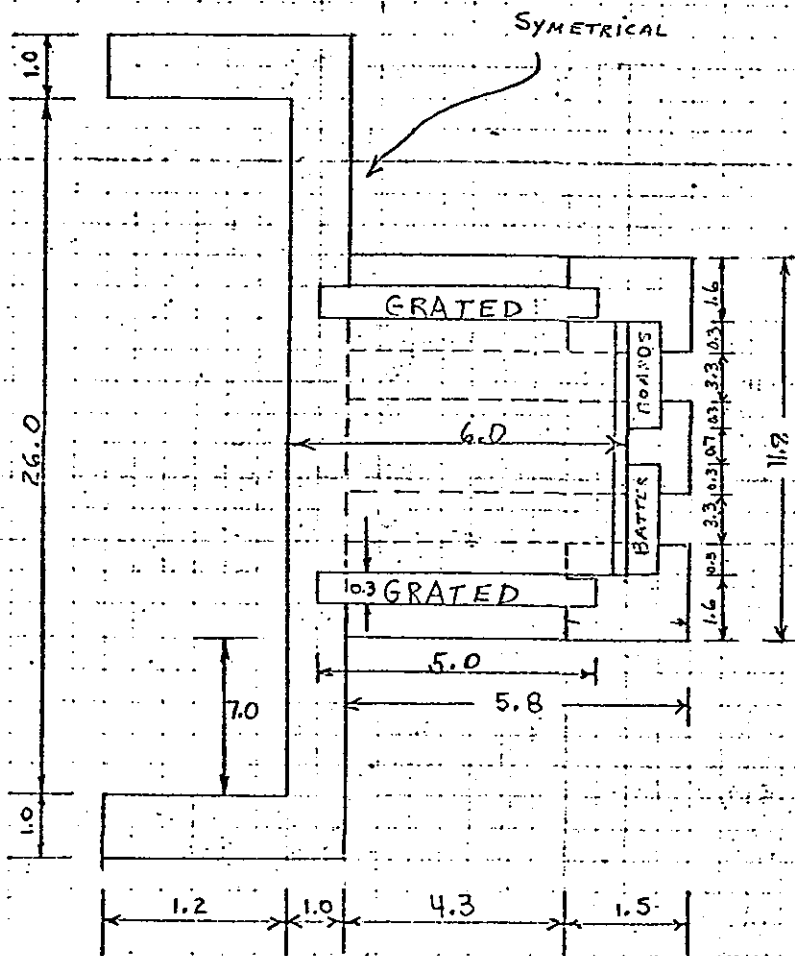
Southerly sluice is topped by 8". Some erosion of the concrete and stone wall downstream of southerly sluice has occurred. Flanking on northerly side of downstream wall. Northerly sluice is still blocked; should be cleaned to relieve flow through southerly sluice. Discharge provisions inadequate. Downstream channel beyond buildings is in good condition.

Supplement to original report and data by Hayden, Harding & Buchanan, Inc.

DAM NO. No - 1

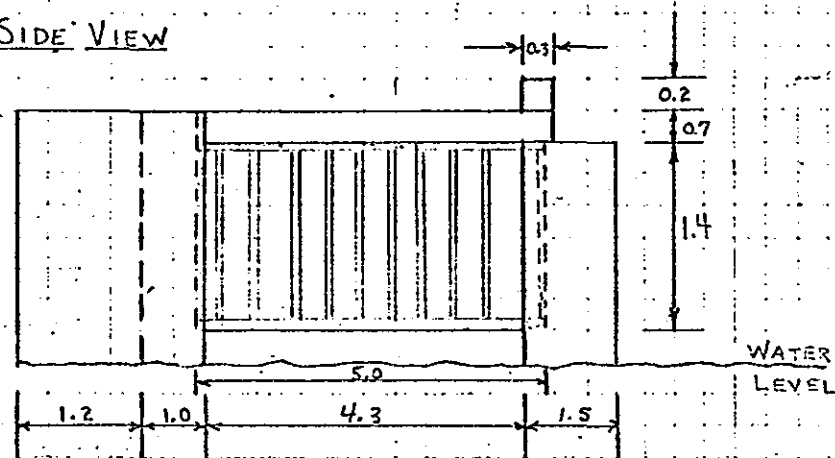


CHARTLEY POND DAM

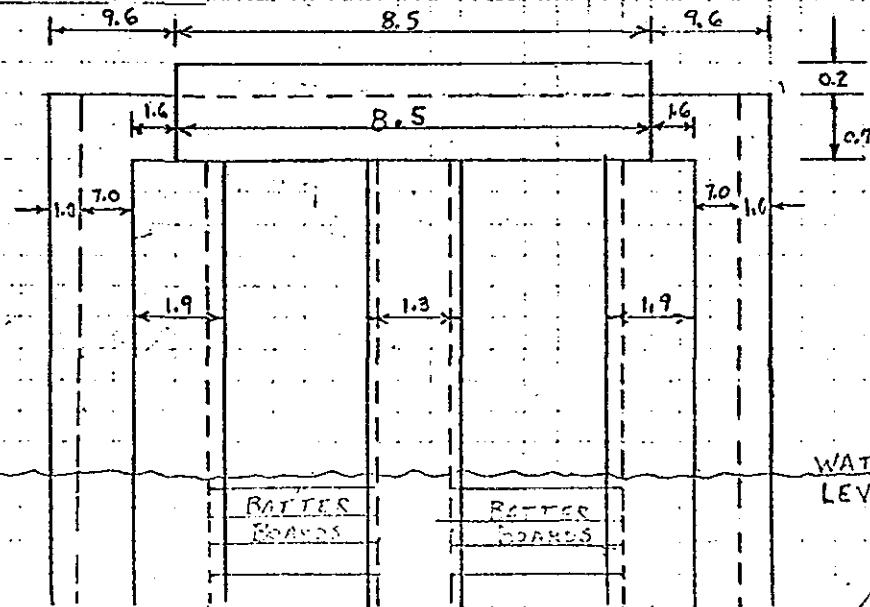


.5/74

SIDE VIEW



FRONT VIEW



# INSPECTION REPORT - DAMS AND RESERVOIRS

OK  
file

Location: City/Town Norton Dam No. 6-3-219-1  
 Name of Dam Chartley Pond INSPECTED BY: A. Lounsbury  
 Date of Inspection 6-3-74

Inspector/s: Per: Assessors ✓ Prev Inspection \_\_\_\_\_  
 Reg. of Deeds \_\_\_\_\_ Pers. Contract \_\_\_\_\_

Name Sinclair, H. G. St. & No. 50 Worcester St. City/Town Norton, Mass State \_\_\_\_\_ Tel No. \_\_\_\_\_

Name \_\_\_\_\_ St. & No. \_\_\_\_\_ City/Town \_\_\_\_\_ State \_\_\_\_\_ Tel No. \_\_\_\_\_

Name \_\_\_\_\_ St. & No. \_\_\_\_\_ City/Town \_\_\_\_\_ State \_\_\_\_\_ Tel No. \_\_\_\_\_

Detaker (if any) e.g. superintendent, plant manager, appointed by absentee owner, appointed by multi owners.

Name \_\_\_\_\_ St. & No. \_\_\_\_\_ City/Town \_\_\_\_\_ State \_\_\_\_\_ Tel. No. \_\_\_\_\_

Number of pictures taken none

Degree of Hazard: (If dam should fail completely)\*

1. Minor ✓ 2. Moderate \_\_\_\_\_  
 3. Severe \_\_\_\_\_ 4. Disastrous \_\_\_\_\_

This rating may change as land use changes (Future development)

Outlet Control: Automatic \_\_\_\_\_ Manual ✓

Operative ✓ yes ; \_\_\_\_\_ No. \_\_\_\_\_

Comments: \_\_\_\_\_

Stream Face of Dam: Condition\*

1. Good ✓ 2. Minor Repairs \_\_\_\_\_  
 3. Major Repairs \_\_\_\_\_ 4. Urgent Repairs \_\_\_\_\_

Comments: \_\_\_\_\_

stream Face of Dam: Condition: 1. Good ✓ 2. Minor Repairs \_\_\_\_\_  
 3. Major Repairs \_\_\_\_\_ 4. Urgent Repairs \_\_\_\_\_

Comments: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Spillway: Condition: 1. Good ✓ 2. Minor Repairs \_\_\_\_\_  
 3. Major Repairs \_\_\_\_\_ 4. Urgent Repairs \_\_\_\_\_

Comments: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Water level @ time of inspection: 2' ft. above \_\_\_\_\_ below ✓ \_\_\_\_\_  
 top of dam ✓ principal spillway \_\_\_\_\_  
 other \_\_\_\_\_

Summary of Deficiencies Noted:

Growth (trees and brush) on Embankment 1 Tree  
 Animal Burrows and Washouts none  
 Damage to slopes or top of dam "  
 Cracked or Damaged Masonry "  
 Evidence of Seepage "  
 Evidence of Piping "  
 Erosion "  
 Leaks "  
 Trash and/or debris impeding flow "  
 Clogged or blocked spillway "  
 Other "

Overall Condition: Safe  
No minor repairs needed

## DESCRIPTION OF DAM

DISTRICT 6Submitted by A. LounsburyDam No. 6-3-218-1Date 6-5-74City/Town NortonName of Dam Chartley PondLocation: Topo Sheet No. 33-A

Provide 8 1/2" x 11" in clear copy of topo map with location of Dam clearly indicated.

Year/s of subsequent repairs unknownPurpose of Dam: Water Supply ☒ Recreational ☒  
Irrigation ☐ Other ☐Catchment Area: 4.46 sq. mi. 2856 acresTotal D.A. 8.2 sq. mi. 4223 Acres 5260Normal Ponding Area: 50.5 Acres; Ave Depth 6.1Impoundment: 98732,550 gals; 303 acre ft.and type of dwellings located adjacent to pond or reservoir 1 Cafee. summer homes etc. 1 Summer homeDimensions of Dam: Length 250' ± Max. Height 8' ±Slopes: Upstream Face VerticalDownstream Face 12:1Width across top 45' ±

Classification of Dam by Material:

Earth ☐ Conc. Masonry ☒ Stone Masonry ☐Timber ☐ Rockfill ☐ Other ☐Description of present land usage downstream of dam: 100% Rural; 0% Urban.Is there a storage area or flood plain downstream of dam which could accommodate the impoundment in the event of a complete dam failure YES ☒ NO ☐

BK 17916 (120, 121)

Architectural drawing of a building section showing a central corridor with two rooms on either side. The drawing includes dimensions for the overall width (26.0), room widths (8.0), and corridor width (2.2). The corridor is labeled "CORRIDOR" and the rooms are labeled "ROOMS". The drawing is oriented horizontally with the corridor running vertically.

A diagram showing a rectangular area. The top horizontal dimension is labeled 22.48. The left vertical dimension is labeled 5.0. A vertical strip of 10 equal rectangles is shown on the left side of the main area. The bottom horizontal dimension is labeled 9.0.

CHARTLEY POND

96.31

$\frac{1}{x}$  6.0  
 $\frac{1}{x}$  3.0  
 $\frac{1}{x}$  0.75  
 $\frac{1}{x}$  0.2

Boyer A4?  
30.5

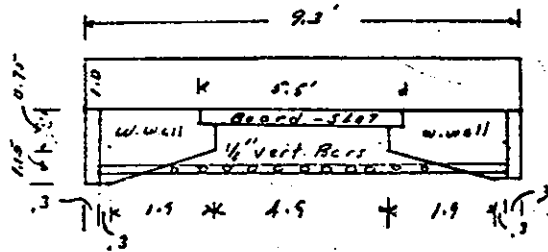
# CHARTLEY POND DAM

SCALE 1" = 4'

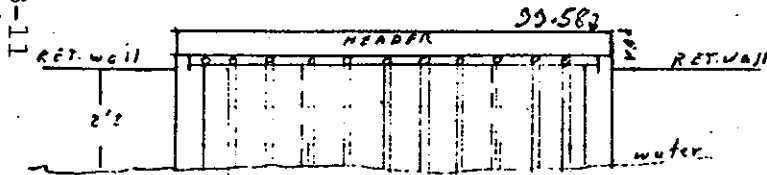
Struct A - 0493

BK 17916 19119

Top View



Front View



SCALE 1" = 4'

(over)

Assumed Engr. P. 124

Nail  $\phi$  #601 (up 1.0) S. Worcester St.  
100.00

CHARLEY POND DAM

Chartley Pond - Norton 6-3-218-1 BK 17916 Pg 118, 122, 123

Pgs 013

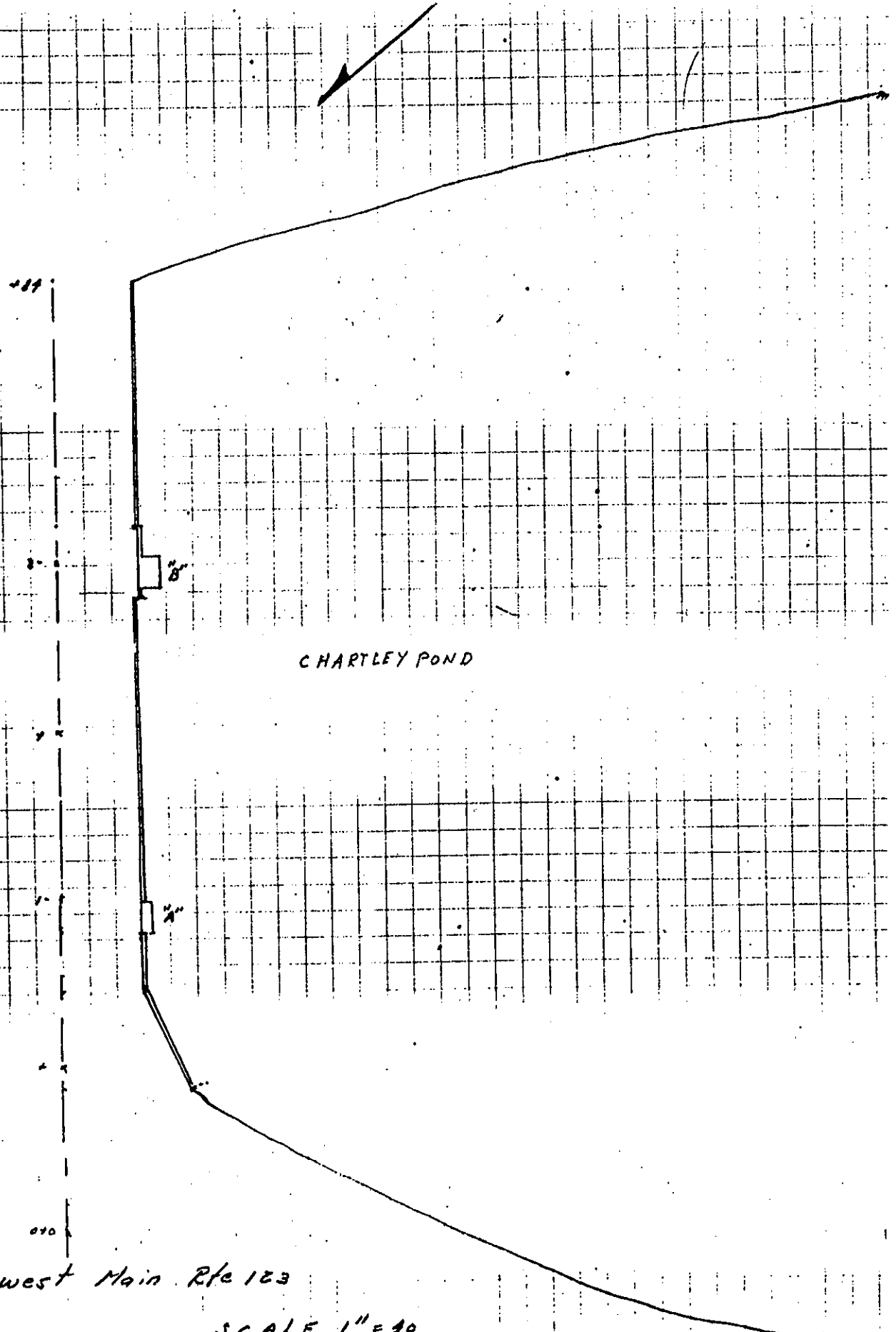
So WORCESTER St.

West Main Rte 123

SCALE 1" = 40

B-12

CHARTLEY POND DAM



APPENDIX C  
PHOTOGRAPHS

CHARTLEY POND DAM





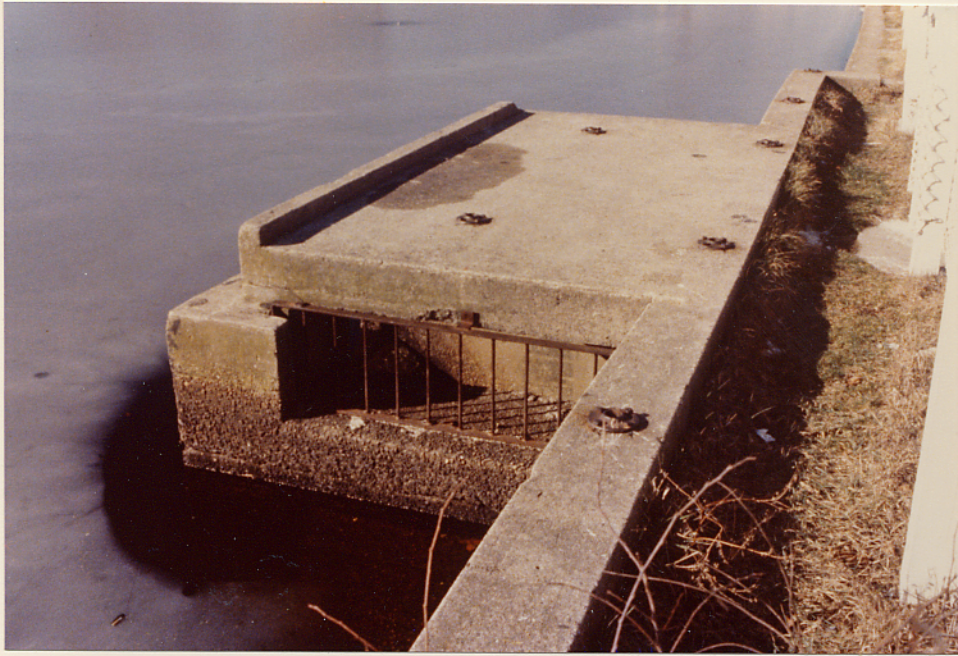
**NO. 1 VIEW OF UPSTREAM FACE**



**NO. 2 VIEW OF ROADWAY ACROSS CREST OF DAM**

CHARTLEY POND DAM





**NO. 3 VIEW OF OUTLET STRUCTURE**



**NO. 4 VIEW OF DOWNSTREAM CHANNEL**

CHARTLEY POND DAM





**NO. 5 VIEW OF DISCHARGE CONDUIT THROUGH DAM**



**NO. 6 VIEW OF OUTLET AND DOWNSTREAM DISCHARGE CHANNEL**

CHARTLEY POND DAM

APPENDIX D  
HYDROLOGIC AND HYDRAULIC  
COMPUTATIONS

	<u>Page</u>
Figure D-1, Drainage Area Map	D-1
Computations	D-2

CHARTLEY POND DAM





**I** Test Flood, Storage & Storage Functions

1- Total Drainage Area - 6.77 mi<sup>2</sup>

2- Pond(s) Area: 0.12 + 0.02 + 0.02 =

Swamp(s) Area: .11 + .17 + .25 + .05 + .10 + .06 + .08 + .06 + .58 + .23 + .15 = 1.84 "

Total Area Pond(s) & Swamp(s):

0.16 mi<sup>2</sup>  
2.00 "

$$\% \text{Ponds \& Swamps} = \frac{2.00}{6.77} = \underline{29.5\%}$$

3-  $\frac{173-103}{10,000} = .007$  } Say Ave Slope = 0.7%

4- Using C. of E. Curves for Peak Flow Rates & above guide values the Peak Flow Rate was estimated to be below "Flat & Coastal" and taken at 400 c.f.s./mi<sup>2</sup>  
 Size Class: Small ; Hazard Pot.: High ; Spill. Des. Flood: 1/2 to Full PMF  
 Use: Test Flood = 1/2 PMF

5- Test Flood Inflow = 1/2 (400) 6.77 = 1400 c.f.s.

6- Pond Storage

The pond area is 0.12 sq. mi. at elev. 103.

Based on a const. area, storage increases at 74.4 ac. feet per foot of depth increase.

Under peak flood flows add storage in pond south of Peckham St with ± 13 acre (.02 mi<sup>2</sup>) area

7- Spillway crest elev. is 102.7

8- Storage Functions are based on  $Q_{out} = Q_{in} [1 - \frac{S_{out}}{R}]$

$S_{out}$  = Storage Vol. in Reservoir related to final  $Q_{out}$  in terms of inches of rain over the drainage area.

$$S(\text{in Inches}) = 12 D \left( \frac{0.12 + 0.02}{6.77} \right) = 0.25 D ; R = 6 \text{ hr rain of storm.}$$

D = Storage depth in feet above spillway crest in reservoir

9- Storage Functions: (Test Flood & 1/2 PMF - if needed)

$F_{TF} = 1400$	$- 147$	$S = 1400 - 36.8 D$
$F_{1/2 PMF} = F_{TF}$	$-$	$S = - D$

## II Discharge Relations

### A - Spillway

2 - 3.35' wide stoplog weirs w/ exist. crest el. 102.7 for  $Q_1$   
 2 - 4.25' wide fixed weirs with crest el. 104 for  $Q_2$   
 Both of above are covered by slab with bot. el 105.3 ±  
 Say: all of above become orifices for pond elev > 106  
 Use "Hydr. Tables" Williams & Hazen, for weir flow ( $p=30$ )  
 Use  $Q = C_d A \sqrt{2gH}$  for orifice flow w/  $C_d = 0.61$  [85.3 ft/s & 54.1 ft/s]

Pond El.	103	104	105	106	107	108	109	106
$Q_1$	4	30	80	130	150	170	190	120
$Q_2$	-	-	30	80	80	100	110	60
$\Sigma Q_s$	4	30	110	210	230	270	300	180
	← Weir →				← Orifice →			

### B - Crest Flow

Use  $g = 2.55 H^{1.5}$  [Ref.: V.T. Chow "Open Chan Hydr" pg 52]  
 Crown of So. Worcester St controls: 130' @ 105.7 ± & 110' @ 106.1 ±

Pond El.	106	107	108
$Q_1$	50	490	1100
$Q_2$	-	240	730
$\Sigma Q_c$	50	730	1890

### C - Culvert Capacity - as pipe

1 @ 3.0 wide x 5.3' hi - 90' long - Elev. of outlet 100.6 ±  
 1 @ 3.5' wide x 6.1' hi - 80' long Elev. of outlet 100.6 ±

$$\text{Avail. Hd.} = H_p = \text{Ent Loss} + \text{Exit Loss} + \text{Frict.} \approx \frac{V^2}{2g} [0.5 + 1.0 + 0.5] = 2 \frac{V^2}{g}$$

Ent. Water El.	103	104	105
$H_p$	2.4	3.4	4.4
$V$	8.4	10.5	11.9
$Q_1$	140	167	189
$Q_2$	188	224	254
$\Sigma Q_p$	328	391	443

By inspection, culvert capacity will not control discharge under pipe flow control.

## II Discharge Relations - cont.

### D - Low Level Outlet

1- Assume Partial Removal of Spillway Stoplogs to new crest elev. 101.7 with pond at elev. 102.7.

$$\text{Initial disch.} = 2(3.35)(3.33 \text{ cfs/ft.}) = 22 \text{ cfs}$$

$$\text{Time to lower pond 1} = \frac{(0.12 + 0.02) 43560 (640)}{\frac{1}{2}(22) 3600} = 98 \text{ hours - too long?}$$

2- Assume Partial Removal of Stoplogs to new crest elev. of 98.7 with pond at elev. 102.7 [say bot. 2' silted up]

$$\text{Initial disch.} = 2(3.35)(26.35 \text{ cfs/ft.}) = 176 \text{ cfs}$$

$$\text{Time to lower pond 1} = \frac{.14 (43560) 640}{\frac{1}{2}(176) 3600} = 12.3 \text{ hours}$$

## III Crest Flow Conditions

### "A" - Stoplogs in as Found

Pond El. under Test Flood - 107.30

L.P. on Crest (street crown) - 105.57

$$1.73'$$

$$\text{Max. Crest Flow} = 2.55(1.73)^{1.5} = 5.80 \text{ cfs/ft.}$$

Under "Critical Flow" conditions.

$$y_c = 1.01 \text{ ft}$$

$$V_c = 5.71 \text{ fps.}$$

### "B" - Stoplogs removed

$$\text{Max. depth on crest} = 106.8 - 105.57 = 1.23'$$

$$\text{Max. Crest Flow} = 2.55(1.23)^{1.5} = 3.5 \text{ cfs/ft.}$$

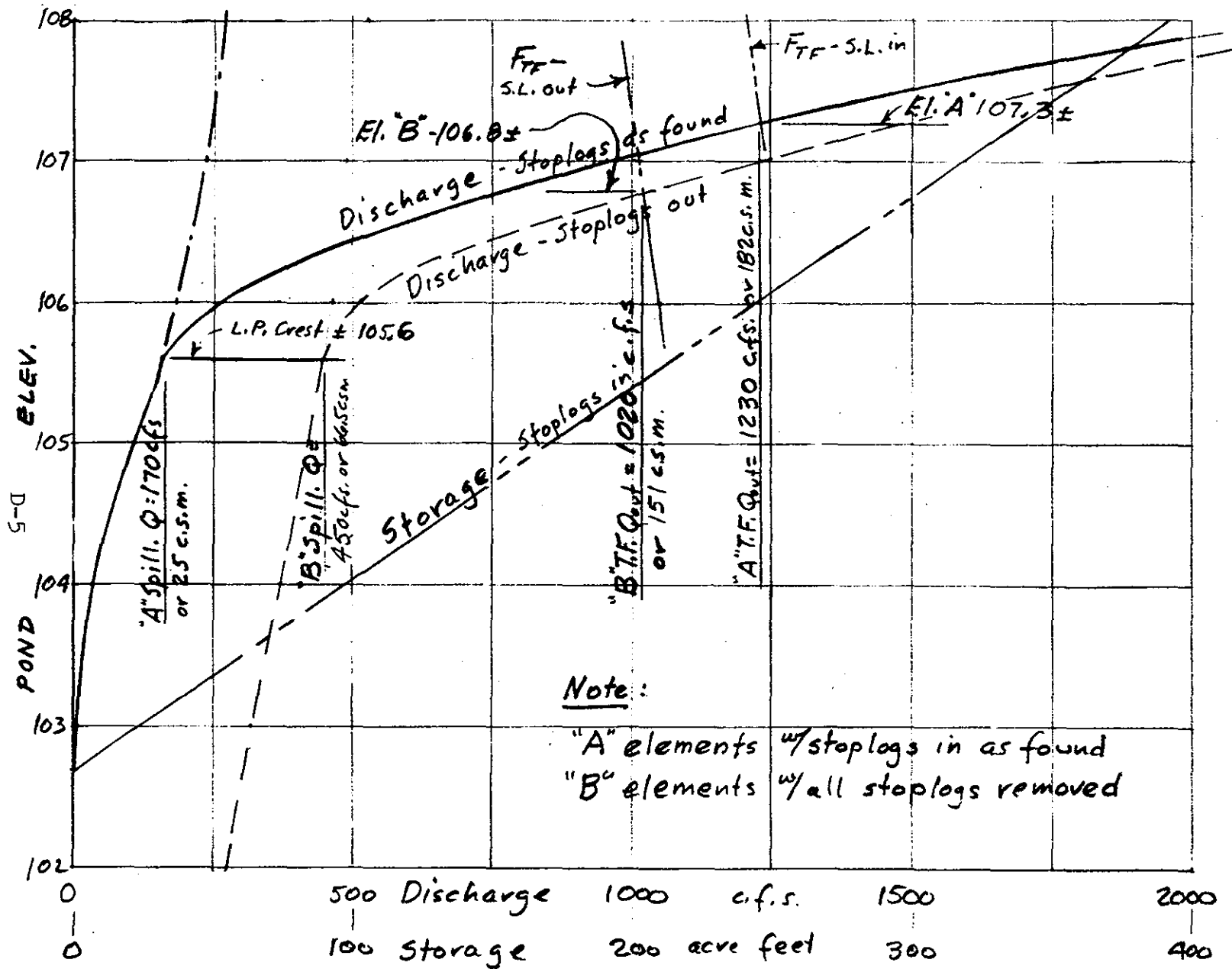
As "Critical Flow",  $y_c = 0.72 \text{ ft.}$

$$V_c = 4.85 \text{ fps.}$$



**IV**

Discharge, Storage & Storage Function vs Pond Elev.



## Ⓡ Failure of Dam

Peak Failure Flow:

Pond Elevation - 105.6 (L.P. Crest in ⓇB)

Toe Elevation - 96.0

$$Y_0 = 9.6$$

Dam Length Subject to Breaching = 55 ft.

$$W_0 = 40\% (55) = 22 \text{ ft}$$

$$Q_P = 1.68 W_0 (Y_0)^{1.5} = 1.68 (22') (9.6)^{1.5} = 1100 \text{ cfs}$$

Disch. @ pond el. 105.6 = 180 cfs. Total failure flow = 1280 cfs

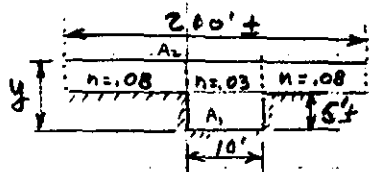
Storage Volume Released:

Storage Above Spillway  $3.0 (74.4) = 223 \text{ ac. ft.}$

Storage Below Spillway  $\frac{1}{3} 6.7 (74.4) = 166 \text{ "}$

$S = \text{Total Storage} = 389 \text{ "}$

Channel Hydraulics:



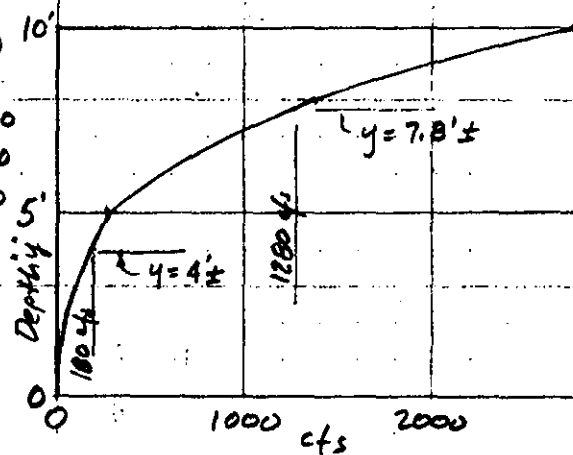
$$S \approx \frac{2}{1600}; R_1 \approx y, R_2 \approx (y-5')$$

$$V_1 = \frac{1.49}{1.03} .035 y^{2/3} = 1.756 y^{2/3} \text{ (Main Channel)}$$

$$V_2 = \frac{1.49}{1.03} .035 (y-5)^{2/3} = 0.658 (y-5)^{2/3}$$

y	A <sub>1</sub>	A <sub>2</sub>	V <sub>1</sub>	V <sub>2</sub>	Q <sub>1</sub>	Q <sub>2</sub>	Q
5	50	-	5.13	-	257	-	260
10	100	1000	8.2	1.9	815	1925	2740
8	80	600	7.0	1.4	562	822	1380

Failure increases depth 3.8' ±  
This produces 2.8' ± overbank  
depth near stream



Time to Drain:

$$\frac{43560 (389)}{3600 (\frac{1}{2}) (1100)} = 8.6 \text{ Hours. or } 513 \text{ minutes}$$

VI Special Discharge Relation

Purpose: Determine effect of removal of all or major number of stoplogs.

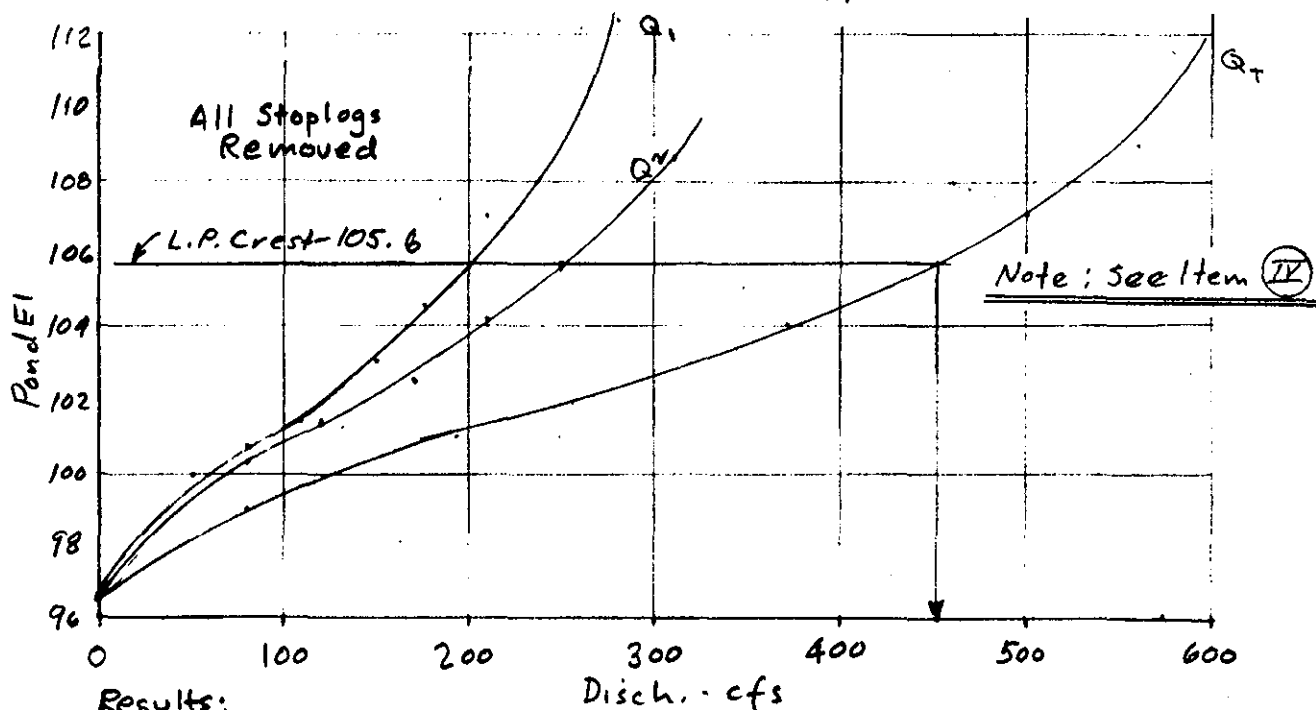
A - Calc. Culvert Capacity under Inlet Control

Ref.: V.T. Chow "Open Chan. Hydr." Fig. 17-29

Culvert #1 - 3.0' wide x 5.3' high } Data based on  
 Culvert #2 - 3.5' wide x 6.1' high } outlet conditions  
 Invert El. 96.5

H/d	0.6	0.8	1.0	1.25	1.5	2.0	3.0
$Q_1$	16.5	26	37	48	58	69	91
$Q_2$	50	80	110	145	170	210	270
Pond El.	99.7	100.7	101.8	103.1	104.5	107.1	112.4

$Q_2$	23	33	48	60	72	89	120
$Q_1$	80	120	170	210	250	310	420
Pond El.	100.2	101.4	102.6	104.1	105.7	108.7	114.8



Results:

All stoplogs removed; initial pond elev. 96.5; storage to low point - 105.6  
 Storage Depth - 9.1'; T.F. out =  $1400 - 36.6(9.1) = 1067$  cfs. } Dam would  
 Max. discharge at pond elev. 105.7 = 450 " } over top

APPENDIX E  
INFORMATION AS CONTAINED IN THE  
NATIONAL INVENTORY OF DAMS

CHARTLEY POND DAM



# INVENTORY OF DAMS IN THE UNITED STATES

(1) STATE	(2) IDENTITY NUMBER	(3) DIVISION	(4) STATE	(5) COUNTY	(6) CONGR. DIST.	(7) STATE	(8) COUNTY	(9) CONGR. DIST.	(10) NAME	(11) LATITUDE (NORTH)	(12) LONGITUDE (WEST)	(13) REPORT DATE DAY   MO   YR
MA	R11	FED	MA	005	10				CHARTLEY POND DAM	4157.0	7113.6	17 APR 79

(14) POPULAR NAME	(15) NAME OF IMPOUNDMENT

(16) REGION BASIN	(17) RIVER OR STREAM	(18) NEAREST DOWNSTREAM CITY-TOWN-VILLAGE	(19) DIST FROM DAM (MI.)	(20) POPULATION
01 06	TR-THREEMILE RIVER	NORTON	0	9869

(21) TYPE OF DAM	(22) YEAR COMPLETED	(23) PURPOSES	(24) STRUCTURAL HEIGHT (FT.)	(25) HYDRAULIC HEIGHT (FT.)	(26) IMPOUNDING CAPACITIES	
					MAXIMUM (ACRE-FT.)	NORMAL (ACRE-FT.)
REPECT	1890	R	10	10	430	230

DIST OWN FED R PRV/FED SCS A VER/DATE

FED N N N N

(27) REMARKS
22-DATE APPROXIMATE

(28) D/S HAS	(29) SPILLWAY			(30) MAXIMUM DISCHARGE (FT.)	(31) VOLUME OF DAM (CY)	(32) POWER CAPACITY		(33) NAVIGATION LOCKS									
	CROSS LENGTH	TYPE	WIDTH (FT.)			INSTALLED (MW)	PROPOSED (MW)	NO.	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)			
1	240				6700												

(34) OWNER	(35) ENGINEERING BY	(36) CONSTRUCTION BY
TOWN OF NORTON	UNKNOWN	UNKNOWN

(37) REGULATORY AGENCY			
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NONE	NONE	NONE	NONE

(38) INSPECTION BY	(39) INSPECTION DATE DAY   MO   YR	(40) AUTHORITY FOR INSPECTION
METCALF AND EDDY INC.	01 DEC 78	PUBLIC LAW 92-367

(41) REMARKS